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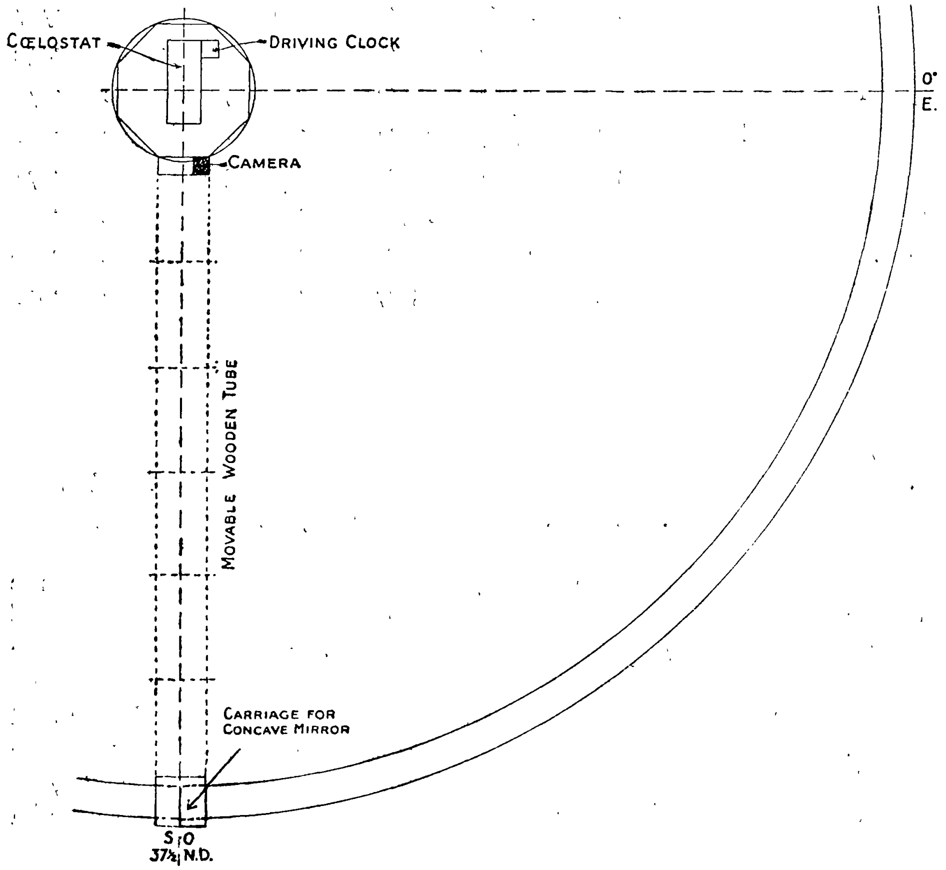
Description of a 24-inch long-focus Cœlostat Reflector.

By J. H. Reynolds.

The idea of mounting a long-focus reflector in conjunction with a cœlostat was mentioned by Dr. Common in 1900, and it has been successfully carried out at Mount Wilson with the Snow telescope for spectroheliographic work. The present instrument is intended for use with a spectroheliograph which is in course of construction, but it is also arranged for photographing the Moon and planets, and the brighter star clusters and nebulæ. For several reasons it was found advisable to keep the focal length within moderate limits; the concave mirror has therefore been made with a focal length of 38 ft., an enlarging lens being used when a greater scale is required.



The cœlostat is mounted in an octagonal wooden house, which revolves so as to face the various azimuths required; the roof revolves separately, and has a large opening covered with hinged shutters. The plane mirror, which is 28 in. in diameter, is furnished with a slow motion at right angles to the polar axis; this is very useful for getting the object in the centre of the field, and is practically indispensable for lunar work.

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At the required distance from the cœlostat house a circular rail has been fixed for carrying the concave mirror. This rail runs from east to south, and gives a range in declination of 37½°. This, of course, is a limited range, and is the main defect of this form of mounting, especially for stellar and nebular work.

The concave mirror is slightly tilted, so as to bring the focal plane a little to one side of the plane mirror, thus forming a Herschelian reflector: with the long focal ratio this does not materially affect definition, and it would be quite possible to alter the form to the Newtonian if found necessary. For stellar work the following is done by means of an eyepiece with double cross-wires near the edge of the plate, and the plate-holder and screw motions can be rotated to bring the star trails parallel with the R.A. screw motion.

For the Moon and planets a negative enlarging lens is employed, and it has been found that with suitable air-conditions an equivalent focal length of 120 feet can be employed with advantage. Although the resulting photograph is not usually so crisply defined as one taken in the primary focus, there is an evident gain in detail, and the disadvantage of "grain" in the plate is not so obtrusive.

In order to eliminate as far as possible uneven motion in the instrument, it is intended, when the enlarging lens is used, to move the plate-holder by means of an oil cylinder, instead of driving the cœlostat. By this means a smooth, continuous motion is possible, and there is the additional advantage that the concave mirror need not be moved in azimuth for the different declinations required, as it is not necessary for the plane mirror to be parallel with the polar axis. The instrument is also well adapted for large-scale photographs of the solar surface.

It has been found desirable to cover in the space between the cœlostat house and the concave mirror with a movable wooden tube; unless this is used, the ground air-currents interfere with good definition.

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On Dr. Roberts' method of determining the absolute dimensions of an Algol Variable Star. By the Rev. J. Stein, S.J., Sc.D.

(*Communicated by Professor H. H. Turner.*)

In an interesting article of the January number, 1906, of the *M.N.* (vol. lxvi. p. 123), Dr. Alex. Roberts starts from the hypothesis that the light-changes of the Algol variables U Pegasi and RR Centauri are fairly well explained by two eclipsing stars moving in a circular orbit, and tries to reduce the residuals (O—C) by applying some corrections to the theoretical light-curve. He supposes that the orbit is passing through the line of sight, and puts—

P = Period of variable in minutes.

ϵ (very small) = Eccentricity of Orbit.

λ = Longitude of periastron, reckoned from line of sight.

θ = True angular distance of eclipsing star from line of sight at time T.

Δm = Change in magnitude per minute at time T.

l = Time (in minutes) that light takes to cross the semi-orbit.

Δt = Correction to the assumed time of passing the principal minimum phase.

$p = \epsilon \sin \lambda$, $q = \epsilon \cos \lambda$.

Then, neglecting the second and higher powers of ϵ, he proceeds from the typical equation of condition—

$$\Delta m \cos \theta \frac{2}{n} p + \Delta m \sin \theta \frac{2}{n} q + \Delta m \, \Delta t + \Delta m \, |\cos \theta| \, l + \ldots = (\text{O—C}),$$

where p, q, Δt, l are unknown quantities, $n = \frac{2\pi}{P}$ and $|\cos \theta|$ denotes the absolute value of $\cos \theta$.

According to the author, the three first terms are corrections depending on eccentricity and variation of epoch; the fourth term is the correction due to the fact that light takes an appreciable interval of time to traverse the orbit. (The other corrections will here be left out of consideration.) Hence, resolving the equations of condition after the method of least squares, Dr. Roberts finds l, and consequently the absolute dimensions of the orbit.

It seems, however, that the point of departure of this method is open to criticism. Indeed, the first member of the fundamental equation is not the adequate expression of the corrections due to eccentricity, variation of epoch, and aberration of light.

To show this, let us take the most simple case—that the two components are both spherical, and that the nearly circular relative orbit is passing through the line of sight. In this case the apparent brightness of the binary system is only depending on the apparent distance ρ of the centres of the two spheres, as seen from our Sun.